

# Characteristic of testicular torsion and predictors of testicular salvage: A retrospective study



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## ABSTRACT

**Background:** Testicular torsion is one of the urological emergencies that require immediate scrotum exploration. Characteristics of testicular torsion patients, varied time exploration, and the findings of the degree of testicular torsion at the time of exploration can affect the outcome of the testicles. The study aimed to determine the characteristics of testicular torsion diagnosed patients and identify the predictors of testicular salvage.

**Method:** The method used in the study was cohort retrospective with inclusion and exclusion criteria. Receiver operator characteristics analysis is performed to determine the probability of orchidectomy based on time to exploration and degrees of twist. Multivariate logistic regression tests are performed to identify the factors that cause the testicles to be retained.  $P < 0.05$  was significant.

**Results:** There are 45 patients mostly diagnosed with testicular torsion aged between 12 to 16 years (64.40%). Left testicular torsion was more frequent than the right torsion (82.20%). The etiology of torsion was mostly idiopathic (77.80%). Orchidopexy procedure was performed on 12 testicular torsion patients (26.70%); on follow-up, one patient was found to have testicular atrophy. The time to explore cut-off value 8.5 hours and the 450 degrees of twisting will cause the testis to not survive with the specificity of 83% and 92% and sensitivity of 81% and 82%, respectively. Multivariate analysis shows time to explore and degree of twisting associated with orchidectomy of the affected testis ( $p < 0.05$ ).

**Conclusion:** Patients are relatively young. Not all patients with testicular torsion will manifest typical symptoms of acute, atypical symptoms such as lower abdominal pain, which can be identified as testicular torsion. Mostly affected left testicle. Orchidectomy is the most commonly performed operation on patients. The outcome of testicular torsion can be predicted by observing the time to exploration factor and the degree of testicular torsion in the patient.

**Keywords:** testicular torsion, testicular salvage, predictor.

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## INTRODUCTION

Testicular torsion is a urological emergency that requires immediate scrotal exploration. The incidence of testicular torsion was 1 in 4000 men younger than 25 years.<sup>1,2</sup> The most common causes of testicular torsion were idiopathic, trauma, and sudden changes with ambient temperature. Anatomical abnormalities such as bell clapper deformity were the most common cause. Testicular torsion patients complained of acute scrotal pain, testicular swelling, pain in the lower abdomen and inguinal region, nausea, and vomiting.<sup>3</sup> There can be mild pain or even no pain in the scrotum in some cases. The testicle was twisted higher on physical

examination; examination of the phren sign revealed persistent pain complaints and negative cremaster reflex.<sup>1,3,4</sup>

The main treatment for testicular torsion is to salvage the testis. Therefore, a proper diagnosis and treatment are required. Prompt patient identification with testicular torsion and detorsion in less than 6 hours from the initial onset of the event is the main key to increasing testicular survival.<sup>3,5</sup> Manual lateral detorsion is an initial treatment that can be performed while preparing for surgery for exploration. Exploratory surgery is the gold standard in the treatment of testicular torsion.<sup>6</sup> An orchidectomy is required if the testis is not viable or appears necrotic; in addition, the orchidopexy could be

performed on the contralateral testis. If surgical exploration is delayed, testicular atrophy will occur within 6-8 hours, and necrosis will begin within 10-12 hours after the onset of symptoms. If symptoms have persisted for 24 hours, then the probability of the testis being preserved is only 10%.<sup>5,7-9</sup>

The time factor that affects the possibility of testicular viability is the amount of twisting of the funiculus on the longitudinal axis. Previous research by Howe et al. concluded that testicular viability is determined by the duration of symptoms and degree of twisting.<sup>10</sup> However, in a study conducted by Cimador et al, it was found that the degree of twisting had no significant effect between

patients undergoing orchidopexy and orchidectomy.<sup>7</sup> This study determined the characteristics of patients diagnosed with testicular torsion and identify testicular salvage predictors.

## METHOD

This study is a retrospective cohort design study with medical records from 2016 to 2021 at the Jember Regional Hospital, one of the tertiary referral hospitals in East Java, Indonesia. The medical records of patients diagnosed with testicular torsion are sorted based on ICD 9 and ICD 10. The definitive diagnosis of testicular torsion was based on the post explorative surgery report results. We collected the data related to the patient demographic (the manifestation of symptoms, physical examination results, and ultrasonography result) and clinical findings at the time of exploratory surgery (degree of twisting and the postoperative outcome) were recorded. One-month follow-up data from control patients were also recorded to look for the occurrence of testicular atrophy after orchidopexy was also included. In this study, time to exploration was the first symptom of testicular torsion that appeared until the patient underwent surgery. Testicular atrophy is characterized by a volume difference of >20% compared to the contralateral testis on ultrasonography or by physical examination by a urologist.

Inclusion criteria used in this study were patients over 1-year-old diagnosed with testicular torsion, with the medical record consisting of symptom onset, postoperative reports in the form of degree of twisting, and postoperative outcome. Exclusion criteria used in this study were torsion in neonates, torsion of the appendix testis, and not torsion of the testicle at the time of exploratory surgery. Information bias is a bias that often occurs in retrospective cohorts. Our patient data was stored in two databases, such as electronic and paper-based medical records. The researcher performed crosschecks on both databases, and incomplete data were excluded to reduce bias.

SPSS statistical analysis software platform was used for descriptive data analysis. Comparative test analysis with

Mann Whitney analysis, chi-square, and independent t-test were used. Furthermore, to assess the sensitivity and specificity of the degree of testicular torsion and time to exploration for the risk of orchidectomy or orchidopexy, the Receiver Operating Characteristic (ROC) curve was used. Multivariate logistic regression analysis was used to predict testicular viability based on patient age, degree of testicular torsion, and time to exploration. The p-value <0.05 was significant.

## RESULTS

In the span of a 5-year study period, we can find in **Table 1** based on the age of the patient that 45 patients with testicular torsion were 15.47 years old, most of it was at 12-16 years old (64.4%), the most

affected testicle was the left testis (82,2%). The most common cause was idiopathic 77.8%, followed by 17.8% during activity. The most common symptoms complained were the pain in the testicles in 41% and swelling of the testicles in 32%. Time to exploration in 45 patients diagnosed with testicular torsion at the Institution had an average duration of 14.62 hours, of which the most were those with a duration of more than 6 hours to less than 24 hours, which was 57.7%. Meanwhile, the post exploration procedure outcome showed that 73.3% of patients underwent orchidectomy. Testicular torsion patients who came to our Institution were from referrals to level 1 health care facilities (primary health care) as many as 55.60%, while patients who came alone were 44.40%. Testis torsion degree, time to

**Table 1. Characteristic of Torsion testis in our Institution**

Characteristic	Frequency	(%)
<b>Age (Mean±SD)</b>	<b>15.47±3.6</b>	
< 12 years old	4	8.90%
12-16 years old	29	64.40%
> 16 years old	12	26.0%
<b>History of trauma/activity</b>		
Idiopathic (I)	35	77.80%
At the time of activity (A)	8	17.80%
History of Trauma (T)	2	4.40%
<b>Symptom</b>		
Fever	7	15.60%
Vomiting	9	20.00%
Lower abdomen pain	7	15.60%
Testis pain	41	91.10%
Testis edema	32	71.10%
<b>Laterality Testis</b>		
Sinistra	37	82.20%
Dextra	8	17.80%
<b>Time to exploration (hour) (Mean±SD)</b>	<b>14.62±13.82</b>	
< 6 hours	10	22.20%
6 hours - 24 hours	26	57.70%
> 24 hours	6	13.30%
<b>Direction of Torsio testis</b>		
Counterclockwise	36	80.00%
Clockwise	9	20.00%
<b>Outcome</b>		
Orchiectomy	33	73.30%
Orchidopexy	12	26.70%
<b>Referred from</b>		
Primary health care	25	55.60%
By themself	20	44.40%

SD: standard deviation

**Table 2.** Comparison between prognostic factor and testicular torsion outcome

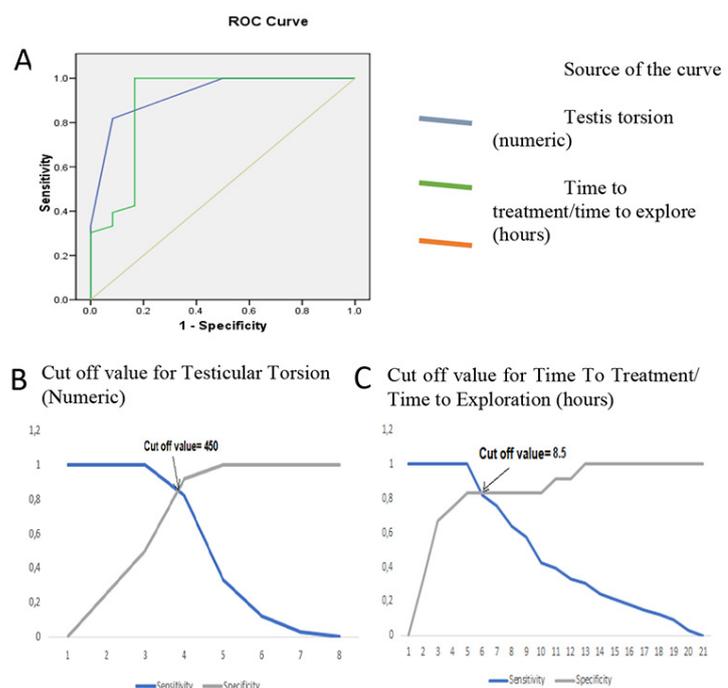
	Orchidectomy		Orchidopexy		P-value	
	n=33		n=12			
	Frequency	%	Frequency	%		
Age (Mean+SD)	15.54±3.77		15.25±3.33		0.812 <sup>t</sup>	
Testis torsion degree						
	<=359	0	0.00%	6	50.00%	0.000 <sup>C</sup>
	360-719	22	66.70%	6	50.00%	
	>=720	11	33.30%	0	0.00%	
Time to exploration (h) (Mean+SD)	17.91±14.67		5.58±4.05		0.000 <sup>M</sup>	
Phren test						
	(-)	31	93.90%	12	100.00%	0.383 <sup>C</sup>
	(+)	2	6.10%	0	0.00%	
Cremastric reflex						
	(-)	31	93.90%	4	33.30%	0.000 <sup>C</sup>
	(+)	2	6.10%	8	66.70%	
Direction of Torsio testis						
	Counterclockwise	24	72.70%	12	100.00%	0.043 <sup>C</sup>
	Clockwise	9	27.30%	0	0.00%	
Outcome Testis						
	Single Testis	33	100.00%	0	0.00%	0.000 <sup>C</sup>
	Testis OK	0	0.00%	11	91.70%	
	Athropy	0	0.00%	1	8.30%	

Note: M= tested with Mann Whitney; C= tested with Chi-square; t= tested with independent t test  
If the value  $p < 0.05$  = means /significant

exploration, cremastric reflex, torsion direction, outcome testis were significantly different between orchidectomy and orchidopexy (Table 2).

The analysis using Receiver Operating Characteristic (ROC) found that the threshold time to exploration was at 8.5 hours (OR: 0.894; with 95% confidence interval: 0.756 – 1.032) with a sensitivity of 81.8% and a specificity of 83.3% for orchidectomy. The ROC obtained a cut-off value of 450 (area under the curve: 0.927 with confidence interval: 0.843 – 1.011) degrees of torsion with a sensitivity of 81.8% and a specificity of 91.7% for orchidectomy.

The higher the degree of testicular torsion increases 0.981 times the risk of experiencing orchietomy (95% CI: 0.969 – 0.993) and patients had 0.862 times the risk of having an orchidectomy in slower exploration time (95% CI: 0.821 – 0.935) (Table 3).



**Figure 1.** The ROC curve of testis torsion and time to treatment/time to explore. A) twisted degree ROC curve and time to explore; B) Cut-off for testicular torsion dispelled degrees; C) Cut-off for time to exploration

**Table 3. The multivariate analysis**

Variable	OR (95% CI)	p-value
Age	1.056 (0,744-1,499)	0.76
Testis torsion degree	0.981 (0,969-0,993)	0.003
Time to exploration	0.862 (0,832-0,935)	0.002

## DISCUSSIONS

One of the acute scrota that require diagnosis and treatment as soon as possible is testicular torsion; delayed treatment will affect testicular viability and patient morbidity. Testicular torsion commonly happens in patients aged 12 to 17.<sup>11</sup> The median age of 12 years is when the testicular volume increases up to 3 mL; this is one of the anatomical risk factors.<sup>12</sup> This suited research that the most age group is 12-18 years old. The incidence of bilateral testicular torsion is rare, whereas left testicular torsion is much more common than right.<sup>13</sup> In this study, 37 of the 45 patients with testicular torsion (82.2%) had left testicular torsion. The diagnosis and management of testicular torsion is a race against time.

The most common cause is idiopathic, including bell clapper deformity and iatrogenic, i.e., due to physical activity and trauma, but less common.<sup>2,12</sup> Our study found that 77.8% occurred without any history of activity and trauma. It is well known that treatment of testicular torsion less than 6 hours from symptom onset increases the probability of testicular viability by 90%-100%;<sup>2</sup> 12 hours delayed treatment can cause the probability of testicular viability to decrease by 50% and to 10% if more than 24 hours. In our study, it can be seen that 71% of patients came after 6 hours. In patients who came less than 6 hours from testicular pain until surgery, the number of the testis that could be preserved was 100%. In comparison, for those who came more than 6 hours to 24 hours, the number of the testis that could be preserved was only 30%, and income more than 24 hours, no testicles are preserved.

History and physical examination in pediatric patients with testicular torsion must be done more thoroughly.<sup>13</sup> Limitations of expressing pain in children

can lead to a misdiagnosis of testicular torsion; besides that, testicular torsion does not always show symptoms of testicular pain, pain in the lower abdominal area without symptoms of testicular pain is a frequent occurrence.<sup>14,15</sup> 15.6% or 7 patients had lower abdominal pain symptoms alone in our study. Therefore, in patients with symptoms of lower abdominal pain, a thorough physical examination of the inguinal and abdominal should be performed. The cremaster reflex has been reported to be absent in 100% of cases of testicular torsion, making it a potentially useful sign in this diagnosis.<sup>16</sup>

However, our study showed that 22% of testicular torsion patients had positive cremasteric reflex. Ultrasonography is required in such an untypical case.<sup>17</sup> In addition, it was found that 55.60% of patients came were referrals from level 1 health facilities at the public health center/clinic. Attempted manual lateral detorsion just before referral by the GP can help increase the likelihood of a viable testis.

The spermatic cord twisting degree has begun to be widely studied with its effect on the outcome of testicular viability. Many previous studies were conducted on experimental animals with testicular torsion and detorsion after a certain period. The results showed a significant relationship between the degree of twisting and the viability rates of the testis.<sup>18</sup> A previous study conducted by Feng et al. on 136 patients with testicular torsion showed a significant relationship between time and degree of torsion in the orchidopexy group. Orchidectomy rate increased at a cut-off of 530 degrees, in testicular torsion with degrees <360, as much as 14.7% could still be saved while at degrees >720 all patients underwent orchidectomy.<sup>19</sup>

Another study by Howe in 229 people diagnosed with testicular torsion found that when the degree of twisting >360

decreased the likelihood that the testis could be preserved, and degree twisting >860 plus a duration of symptoms of more than 15 hours resulted in only a 50% probability of non-salvage.<sup>10</sup> In this study, Howe et al. introduced a formula to calculate the probability of non-salvage of the testis. However, we have to identify the degree of testicular torsion found during exploration in this formula. Meanwhile, the operator's clinical judgment and other operative findings determine whether to perform orchidopexy or orchidectomy at the time of major surgery.

Based on the description above, the degree of testicular torsion between >360 to >540 is a significant point that arterial occlusion begins to occur at that degree, resulting in testicular hypoperfusion, which will reduce the testicular viability results. Based on our research, it was found that the cut-off point was at 450 degrees. When testicular torsion is more than 450 degrees, orchidectomy tends to be performed. We collected follow-up data on orchidopexy patients for atrophy and had orchidectomy. We found post-orchidopexy testicular atrophy with torsion degree >360. A previous study stated that in testicular torsion with a degree of <360, the rate of testicular retention was higher. The lower the degree of testicular torsion would prolong the duration of symptoms.<sup>8</sup> That was in contrast to studies in patients with degrees >360 who have a constant duration of symptoms. Therefore, in the decision to perform orchidopexy with a degree of more than 360 degrees, the possibility of testicular atrophy, follow-up examination after orchidopexy to see testicular volume with orchidometry and ultrasonography is important.

Our study has several limitations. Our research was a retrospective study; we did not have follow-up data on the response time of testicular torsion patients who came to the emergency room until surgery was performed. In addition, we also did not perform routine manual detorsion procedures and did not have data related to manual detorsion treated in health facilities. Before the patient is referred, socialization related to case introduction and management of testicular torsion cases should be initiated in primary health facilities and the wider community. In

Indonesia, there are many places or areas where the patients have to travel even more than 6 hours to get health facilities. Future studies related to testicular torsion about pathological abnormalities in the testis are also important.

## CONCLUSION

Based on the analysis of 45 patients with testicular torsion, Patients are relatively young. Not all patients with testicular torsion will manifest typical symptoms of acute, atypical symptoms such as lower abdominal pain, which can be identified as testicular torsion. Mostly affected left testicle. Orchidectomy is the most commonly performed operation on patients.

It was found that time to explore is one factor that can predict whether the testicular outcome can be maintained or not. The degree of twisting found during exploration is also a factor that can predict the testicular outcome. The appearance of non-specific symptoms such as pain in the lower abdomen has not ruled out the possibility of testicular torsion. A more thorough physical examination and further investigations can help confirm the diagnosis. Providing education to medical personnel, especially regarding non-specific symptoms, and early treatment before referring can help increase the rate of the salvaged testis.

## DISCLOSURE

## AUTHOR CONTRIBUTION

AJ as the first author and researcher; BD and BS as a researcher; ARN as journal preparator and editor.

## CONFLICT OF INTEREST

There was no conflict of interest in this journal publication.

## FUNDING

None

## ETHICAL CONSIDERATION

The ethical committee of Dr. Saiful Anwar General Hospital has approved this study with letter number: 400/121/K.3/302/2021.

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